may be caused by a *minimum surface temperature* (giving maximum air density) along the barometric ridge on which it is situated.

Indeed, the idea that the Bermuda "high," especially when at all persistent, may be produced in the manner suggested seems to be strongly supported by charts 34 and 35 (125 and 126) that give, respectively, the February and May surface temperature of the North Atlantic (**7**).

The Bermuda cold area.—According to the Deutsche Seewarte charts, in crossing the Atlantic along the "belt of highs," a region of minimum surface temperature commonly is met, except during midsummer, in the general neighborhood of the Bermudas. What this low surface temperature is due to is not certain, but it seems to be connected with and dependent upon the strength and temperature of the Labrador current. If so—that is, if the surface temperature of the Bermuda cold area is lowest when the amount of "cold" brought by the Labrador current is greatest and least pronounced when this supply of cold is at a minimum—it clearly follows that the Bermuda "high" and, therefore, the temperature of the eastern United States must depend in part upon the Labrador current; that is, during the winter, the stronger this current the more intense the Bermuda "high," and the greater the excess of the average temperature of the eastern United States above its normal temperature. Hence, during the winter, a strong and persistent Labrador current would seem, through the creation and maintenance of a well-defined Bermuda "high," to give the eastern United States a marine climate and thereby to hold its average temperature well above its normal value. On the other hand, a relatively feeble winter Labrador current would presage the absence of Bermuda "highs," the prevalence of westerly or northwesterly winds, and, therefore, a continental climate and abnormally low temperatures over all the eastern United States.

Hence daily information in regard to the surface temperatures in the region of the Bermuda "high," in addition to the usual meteorological data for the same region, might be of decided help to the American forecaster. Hence, also, if the surface temperature near the Bermudas be controlled by the Labrador current, it is obvious that a proper study and gaging of this current—the measurement of its cross section, velocity, and temperature—if made at the right times and often enough repeated, might furnish information that occasionally would justify a tentative forecast of the type of coming winter weather in the eastern United States weeks or even months in advance.

These latter measurements, those pertaining to the Labrador current, clearly would be difficult, at present, perhaps, entirely impracticable, to make. This fact, however, does not forbid a discussion of their potential meteorological importance.

Of course, if the above is the actual chain of cause and effect, it clearly does not end with the Labrador current, but until this important point is cleared up it would be premature, however obvious the next link, to attempt to follow it further.

CONCLUSION.

The general facts and conclusions of this paper are:

1. Some winters in the eastern United States are unusually mild and others exceptionally cold.

2. During mild winters this part of the country temporarily has a marine climate, during cold ones a continental climate.

3. The type of winter climate, marine or continental, in this section is largely determined by the presence or absence of the Bermuda "high."

4. Persistence, during winter, of the Bermuda "high" gives to the eastern United States a marine and, therefore, for it, an unusually mild climate. Continued absence of this "high," during winter, allows a continental climate and, therefore, exceptionally low temperatures, to extend quite to the Atlantic coast.

5. The cause of the Bermuda "high" seems to be a cold-water surface, a minimum surface temperature, along the belt of highs.

6. This low surface temperature in the region of the Bermudas may depend upon the temperature and strength of the Labrador current.

7. A knowledge of the surface temperature in the region of the Bermuda "high" probably would be of value to the American forecaster.

8. If the Bermuda "high" is, as it seems to be, dependent upon the Labrador current, then proper gaging of this current should give some indication (during winter at least and probably other seasons as well) a fortnight or a month ahead of the type of coming weather in the eastern United States.

9. A persistent strong Labrador current would seem to indicate a subsequent (fortnight or longer) development of a more or less equally persistent Bermuda "high," and through it the prevalence during winter of relatively warm weather throughout the eastern United States. On the other hand a long continued, weak Labrador current would indicate subsequent absence of Bermuda "highs" and the prevalence over the eastern United States of unusually low temperatures.

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INTERNATIONAL SIMULTANEOUS OBSERVATIONS.

As early as 1871, in the development of the meteorological work of the United States Signal Service (now the Weather Bureau) it became evident that our storms on land were affected by so large a portion of the atmosphere that they could not be satisfactorily studied on the thrice-daily weather maps of the United States as then in use. The same difficulty holds good with regard to the weather map of the United States now in use. In June, 1871, at my request the official forecaster, Gen. Albert J. Myer, as chief of the bureau, sent to captains and owners of vessels circulars and forms requesting tri-daily simultaneous meteorological observations at sea, especially along our coasts. This marine work of the Signal Service grew steadily, even rapidly, until 1887, when all its official work in marine meteorology was, by order of the Secretary of War, turned over to the care of the United States Navy.

The next step toward enlarging the sphere of meteorological work in the United States was the successful combination of the whole civilized world in the study of the atmosphere as a unit. Already in July, 1869, Prof. Abbe had offered an international exchange between his own observation system under the auspices of the Cincinnati Astronomical Observatory and Le Verrier's European system.[1] One of the important steps toward attaining this object was to secure its indorsement by the other meteorological services of the world; this was the object of Gen. Myer's trip to Europe and the Vienna Congress in September, 1873. He first secured individual cooperation between the various other services and the United States, which was rather readily accomplished since they were then all favorably disposed toward this country. Finally he brought the project before the International Meteorological Congress for its approval as related in the REVIEW for February, 1914, page 94.

These efforts led to the establishment of the "Bulletin of International Meteorological Observations taken simultaneously at 7:35 a. m. [later changed to 7:00 a. m.], Washington mean time." The published daily bulletins cover the period from January 1, 1875, to June 30, 1884, while the corresponding daily charts extend from January 1, 1875, to December 31, 1887. On June 30, 1884, the publication of the daily bulletin was discontinued, but the daily map, the monthly summary, and the annual review were continued until their final cessation with December 31, 1887. Beginning July 1, 1884, the size of the published daily international chart was enlarged to four times its former size, and about July, 1885, the published monthly charts, accompanying the Monthly Summary and Annual Review, were enlarged to the same size, i. e., to the size of the manuscript compilation.

The international data in these bulletins were carefully worked over into a homogeneous system by rules established before the publication of the first number for 1878, and expressed in both English and metric measures. The daily bulletins appeared regularly just about one year after the dates to which they pertained. The material thus presented was primarily intended as a basis for the study of the dynamics of the atmosphere, and not for climatological study as such. It is a mistake to treat them from the latter point of view; the charts present strictly simultaneous daily conditions over the whole Northern Hemisphere and are based on a larger number of simultaneous observations than those used for the Daily Weather Map of the Northern Hemisphere that began with January 1, 1914.

The Bulletin of International Meteorological Observations with its charts was widely distributed throughout the world; a copy was sent to each of the cooperating observers. The data it contains seem, nevertheless, to have been used by very few persons outside the Weather Bureau. N. A. H. Poincaré, then president of the Meteorological Society of France, used the charts to locate the daily positions of the centers of tropical high pressures; he showed that these move northward or southward according as the moon is north or south of the Equator, thereby establishing the existence of an appreciable fortnightly lunar tide which is, however, without an appreciable influence on our daily weather. John P. Finley,[2] then lieutenant, plotted from the daily charts the distribution of storm tracks throughout the Northern Hemisphere. An interesting, valuable summary of the distribution of pressure and storm tracks is given in the Annual Report of the Chief Signal Officer, United States Army, for 1891, Appendix 17, pages 747–777, and a similar summary compiled by the late Prof. E. B. Garriott is presented on a much larger scale with charts in Weather Bureau Bulletin A.[3]

It has been stated[4] that the Bulletin of International Simultaneous Observations represents the finest piece of international cooperation in precise scientific work that the world has ever seen, paralleled only by the Ephemerides Mannheimensis of 1780–1790, or by Sabine's work in terrestrial magnetism, or by the International Polar Expeditions of 1882–83. It is very regrettable that meteorologists have so far made practically no use of its daily, monthly, and annual maps and its extensive series of homogeneous, simultaneous observations. The large scale of the charts makes them particularly adapted to detailed studies, such as that outlined on page 672, by Prof. W. J. Humphreys.

The Weather Bureau Bulletin of International Simultaneous Observations had a valued supplement in the Tägliche synoptische Wetterkarte des Nordatlantischen Ozeans, issued jointly by the Deutsche Seewarte and the Danske Meteorologiske Institut beginning with 1884; but this expensive publication relates to the North Atlantic ocean only.—C. A.

[1] Assoc. sci. de France, Bull. hebd., Aug. 15, 1869, 6:100.

[2] See Sailors' Handbook of Storm Tracks, etc., by J. P. Finley. Boston, 1889.

[3] **Dunwoody, Henry Harrison Chase.** Summary of International Meteorological Observations. Washington, 1893. 10 leaves, 61 charts. 19 by 23½". (Weather Bureau Bull. A.)

[4] See report of the International Meteorological Congress held at Chicago, Ill., Aug. 21–24, 1893. Part II. Washington, D. C., 1895. p. 257. (Weather Bureau Bull. 11, pt. 2.)

DO CLOUDS YIELD SNOW EASIER THAN RAIN?

By DOUGLAS F. MANNING.

[Dated, Alexandria Bay, N. Y., Jan. 25, 1915.]

In the MONTHLY WEATHER REVIEW for February, 1914, there was published an article of mine under the above title. Perhaps the following brief description of a snowfall that occurred here on January 21, 1915, may be of interest to the readers. The day was almost calm, the temperature hovered around 10°F., and the slight air movement was from the north. The sky had a peculiar grey or milky appearance, the sun shone rather feebly and could be looked at with the naked eye, but there was no halo or corona present; one looking toward the horizon could see that this gauze-like veil of cloud had a tendency to form in rolls running from northeast to southwest, but so thin and shallow that when looking straight upward one could hardly believe that the sky was clouded. From about 9:30 a. m. until some time after 4 p. m., large feathery flakes of snow filled the air. The flakes were of the most exquisite formation; sometimes they ceased falling for a brief period only to start again. The snow fell to the depth of about 4 inches, but was of such a light, fine texture that it would hardly have been measurable as water. It is very certain that no precipitation could possibly have occurred from any such cloud in the summer season. This cloud sheet was of low altitude.